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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 03SEM03PCT		FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/EP2004/051891		International filing date (day/month/year) 24.08.2004	Priority date (day/month/year) 09.09.2003	
International Patent Classification (IPC) or national classification and IPC G06N3/04				
Applicant SEMEION				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)), containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 07.02.2005		Date of completion of this report 10.11.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer: Rinelli, P Telephone No. +31 70 340-		



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/051891

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-33 as originally filed

Claims, Numbers

1-12 as originally filed

Drawings, Sheets

1/12-12/12 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/051891

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-12
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

1. The following documents (D) are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: JP-A-2002366927

D2: P. HARPER, T. SAMAD, J. WHITE: 'Neural Networks', SCIENTIFIC
HONEYWELLER 9,1988, pages 109 to 121

D3: EP-A-0621549

D4: V. VEMURI: 'Artificial Neural Networks in Control Applications', ADVANCES IN
COMPUTER vol. 36, 1992, pages 202 to 254

2. The subject-matter of independent claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

- 2.1 Comparing D1, which is considered to represent the most relevant prior art, with claim 1, D1 discloses (abstract, figure):

A neural network, comprising several nodes forming at least two layers one of which is a so called input layer and the second of which is a so called output layer, and the output layer nodes forming outputs channels for furnishing output data which are the results of the elaboration of the input data, connection being provided between the nodes of the input layer and the nodes of the output layer (see e. g. the illustration), each node of the output layer carrying out a transformation of the input data received from the input layer output data which transformation comprises a first transformation step comprising at least a sub-step consisting in summing the input data received from the input nodes to the said output nodes by weighting the said input data, the output data obtained by the said transformation carried out in an output node (a second layer to which a value obtained by integrating values obtained by multiplying an output of each unit of the first layer by a weight coefficient), being the output data characterised in that in each output node the first transformation step comprises two sub-steps, a first sub-step being a non linear transformation function of the input data received by the output nodes from the input nodes and the second sub-step being

the summing step of the said non linearly transformed input data in the said first sub-step (a first layer to which a value subjected to nonlinear transformation by the preprocessing means is inputted).

The differences between the neural network in claim 1 and the one in D1 are the input data of a database to be entered in the input layer nodes, a second transformation step in the output layer which transforms non linearly the result obtained by the first transformation step in the same layer, the output data obtained by the said transformation carried out in an output node.

The first feature is a common measure, which the skilled person would apply to the teachings of D1 without the exercise of any inventive skill.

The use of non-linear transformation is also a common measure in the field of neural networks (see e. g. D2, page 109, rightmost column lines 15-22 and illustrations on page 111), and the skilled person would apply this feature to the invention disclosed in D1 without the use of any inventive skill.

The position of the first non-linear transformation on the output layer is a simple technical variation, which would be applied by the skilled person to the subject-matter disclosed in D1 without the application of any inventive step.

No surprising effect arises from the combination of these features, and therefore claim 1 can not be considered as inventive (Article 33(3) PCT).

3. The subject-matter of dependent claims 2-5 and 7-12 does not involve an inventive step in the sense of Article 33(3) PCT.
- 3.1 The additional feature of claim 2 is essentially the use of one or more further layers of nodes between the input and the output layers. This feature is disclosed in D1, see e. g. the figure, and therefore the claim does not involve an inventive step (Article 33(3) PCT).
- 3.2 The additional features of claim 3 are the supply of the output data of the nodes of

the input layer to the nodes of the output layer or to the nodes of the first hidden layer or to at least one hidden layer as input data of the nodes of these layers, and the output data of the output layer consist in the elaboration result of the artificial neural network.

Both these features are disclosed in D1, see e. g. the illustration, and therefore claim 3 is not inventive (Article 33(3) PCT)

- 3.3 The additional feature of claim 4, the use of a sinusoidal function as non linear function, is present also in claim 7. For the same reasons as exposed in paragraph 3.5 below, this claim can not be considered as involving an inventive step (Article 33(3) PCT).
- 3.4 The additional features of claim 5 are the multiplicity of input channels for each node of a layer further than the first and a receiver unit for carrying out the first non linear transformation sub-step of the first transformation step for each channel.

The first feature is disclosed in D1 (see the illustration).

Document D1 discloses also a receiver for carrying out the first non linear transformation sub-step (preprocessing means, abstract) on the channels of the input layer (see figure). The placement of these preprocessing means on each channel of the hidden layer is a simple technical variation, which would be applied by the skilled person to the teachings of D1 without the exercise of any inventive skill.

No surprising effect arises from the combination of said features, and therefore claim 5 can not be considered as involving an inventive step (Article 33(3) PCT).

- 3.5 Claim 7 contains features present in claim 1, and the additional feature of using a sinusoidal function as non linear function. This is a well known feature in the prior art (see e. g. D3, fig. 2), which would be applied by the skilled person to the teachings of D1 without the use of any inventive skill.

Therefore, the claim is not inventive (Article 33(3) PCT).

- 3.6 The additional feature of claim 8, the first transformation being constituted by the sine of the input multiplied by a weight proportional to the inverse of the wavelength, is a standard design option, which the skilled person would apply to the teachings of D1 without the exercise of any inventive skill. Therefore, claim 8 can not be considered as involving an inventive step (Article 33(3) PCT).
- 3.7 The additional feature of claim 9 and 11, the use of a sigmoid as a non linear transformation, is a common measure, see e. g. D2 page 109 rightmost column lines 15-22 and illustration on page 111, which the skilled person would apply to the teachings of D1 without any inventive activity. Therefore, said claims are not inventive (Article 33(3) PCT).
- 3.8 The additional feature of claim 10 is the use of a multilayer back propagation. This claim can not be considered as inventive (Article 33(3) PCT) as this feature is a common measure, see e. g. D4, page 225-227: paragraph 2.5.1, which the skilled person would apply to the teachings of D1.
- 3.9 Claims 12 contains the same features as in claim 5. For the same reasons as exposed in paragraph 3.4 above, the claim is not inventive (Article 33(3) PCT).
4. Claim 6 seems to contain subject-matter which may form the basis for an allowable claim, and in particular the tuning of the wavelength on each input coordinate during the learning phase, for the following reasons:

Document D1, which is considered to represent the most relevant state of the art, discloses (abstract):

an artificial neural network characterised in that input data consist in a predetermined number of variables in a input data variable space each variable being defined by coordinates in the input data space (input vector) and each coordinate in the input data space is non linearly transformed in the first transformation step in a corresponding variable value which is made dependent by the spatial position of the coordinate value with respect of a non linear function.

The problem solved by the invention in claim 6 may be regarded as how to improve the performances of a neural network as in the prior art.

The differences between the neural network in claim 6 and the one in D1 are the use of a spatial wave of given wavelength as non linear function, the dependence consisting in multiplying the input coordinate values by the wavelength of a sinusoidal wave which are then transformed into the same value, and the tuning of the wavelength on each input coordinate during the learning phase.

Even though some of the features mentioned above are known in the prior art (namely, the use of a spatial wave of given wavelength as non linear function and the dependence consisting in multiplying the input coordinate values by the wavelength of a sinusoidal wave which are then transformed into the same value, see e. g. EP-A-0621549 fig. 6), their combination gives to a neural network a faster convergence of each weight of each node to its proper value, and therefore, the problem of improving the performances of a neural network as in D1 has to be considered as solved by the combination of the features above. This combination of features can not be predicted by the skilled person taking account only of each single technical feature, as it is the unexpected result of the combination of their effects, and therefore, it has to be considered not obvious (see the Guidelines, 13.14(d)).

For the reasons stated above, this claim is considered as new and inventive (Article 33(2) and (3) PCT).

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